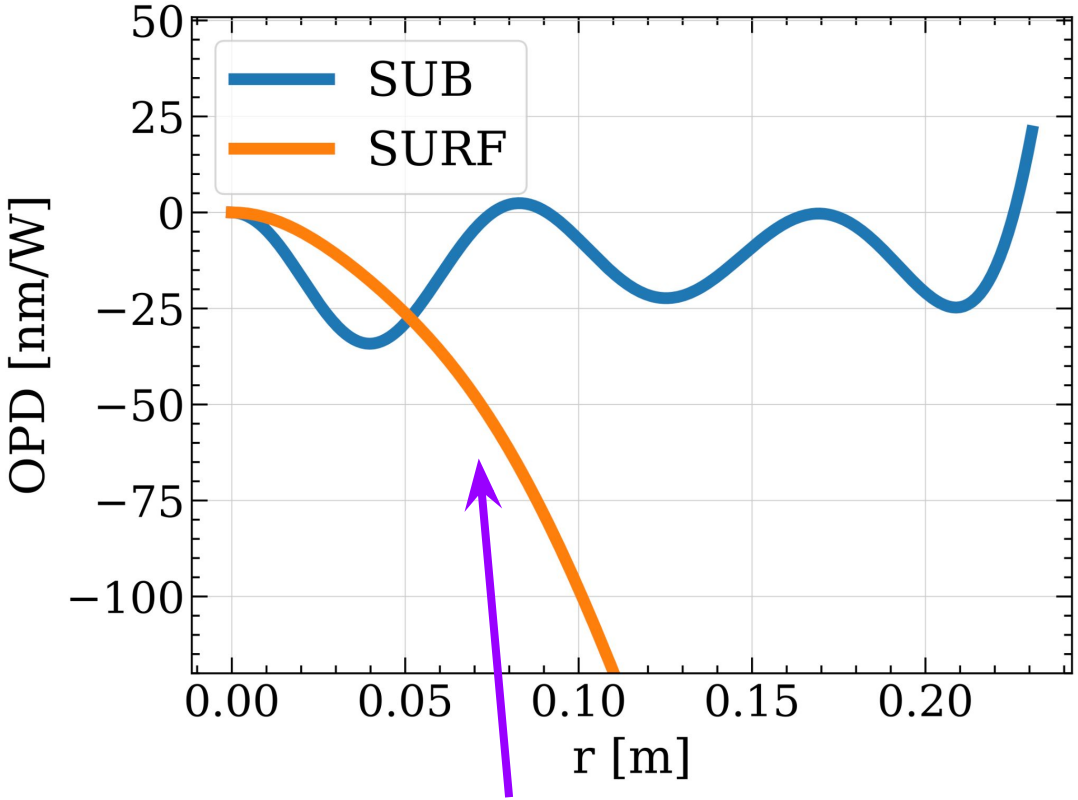
Ring Heater Quadratic Actuation

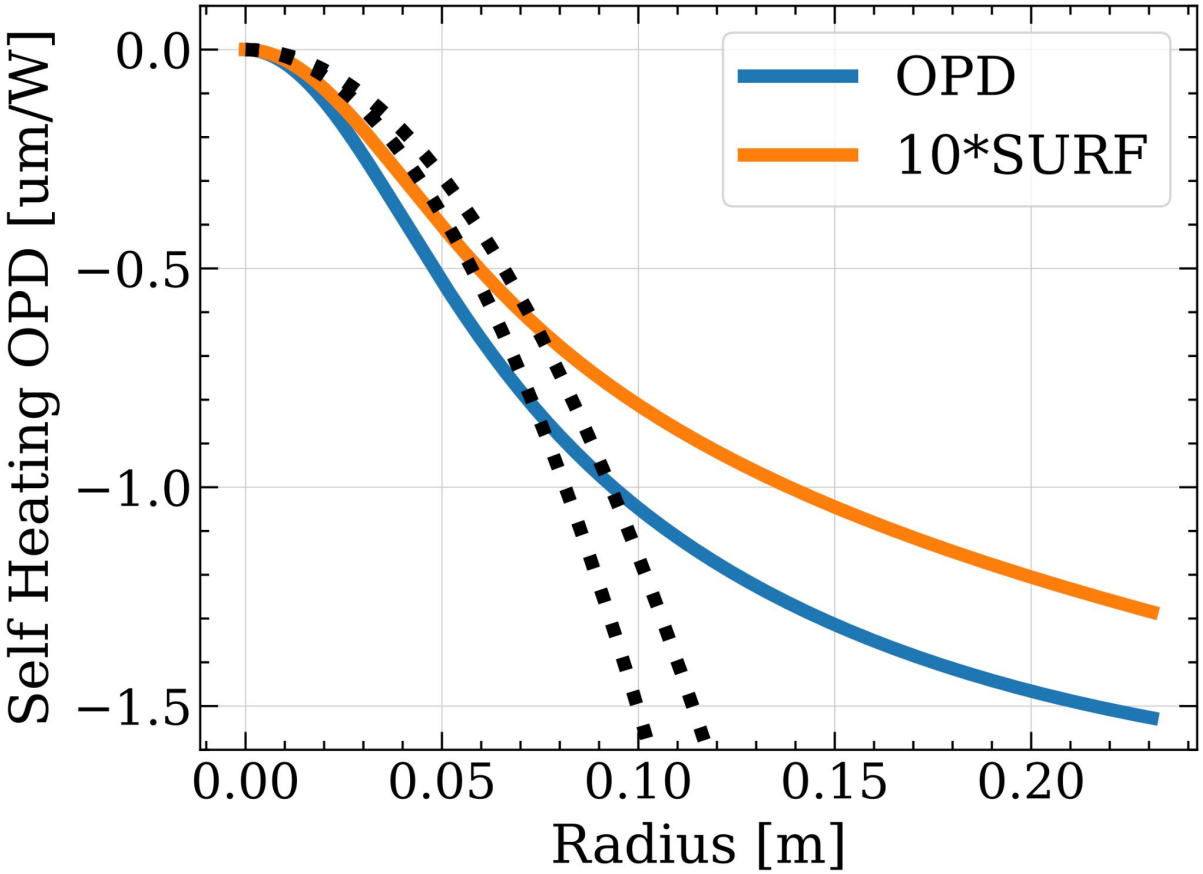


Optimization results for multi-ring FROSTI with 2 heater components:

	Sub. (nm)	Surf. (nm)
2 comp.	10.3	13.6

Residual quadratic deformation on the surface

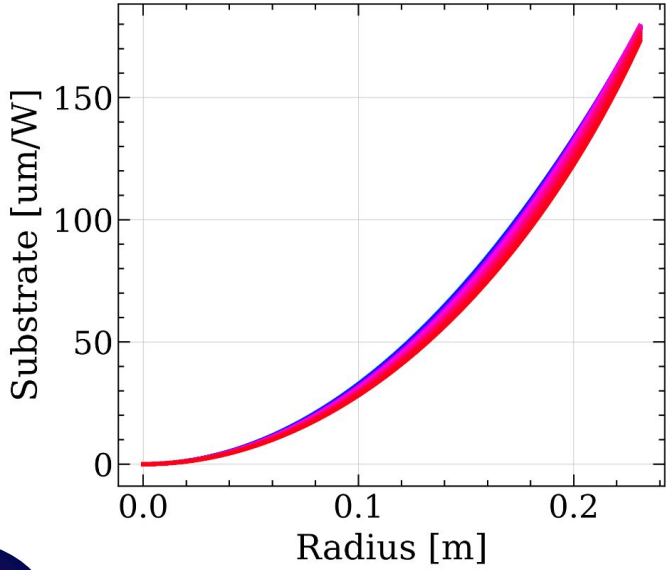
Actuation gain ratio for surface vs. substrate from RH have to match the defocus ratio due to self heating

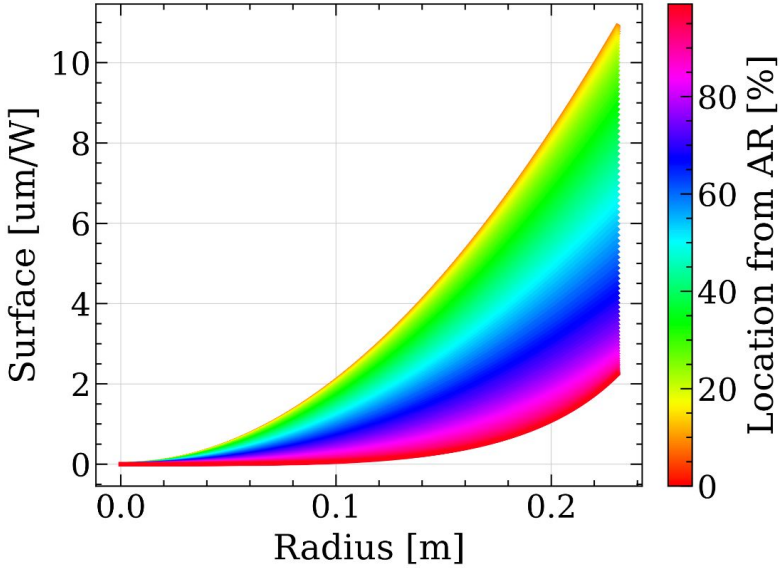


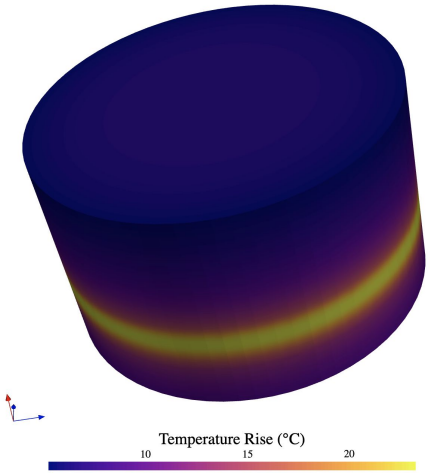
Defocus ratio SURF/Substrate = **0.0767**

The curvature actuation gain ratio from RH have to be close to this number

Ring heater location on the **surface** and **substrate** actuation gains







1. The substrate OPD is not sensitive to the RH location.
2. The surface OPD varies significantly. The closer to the AR, the larger the actuation gain.

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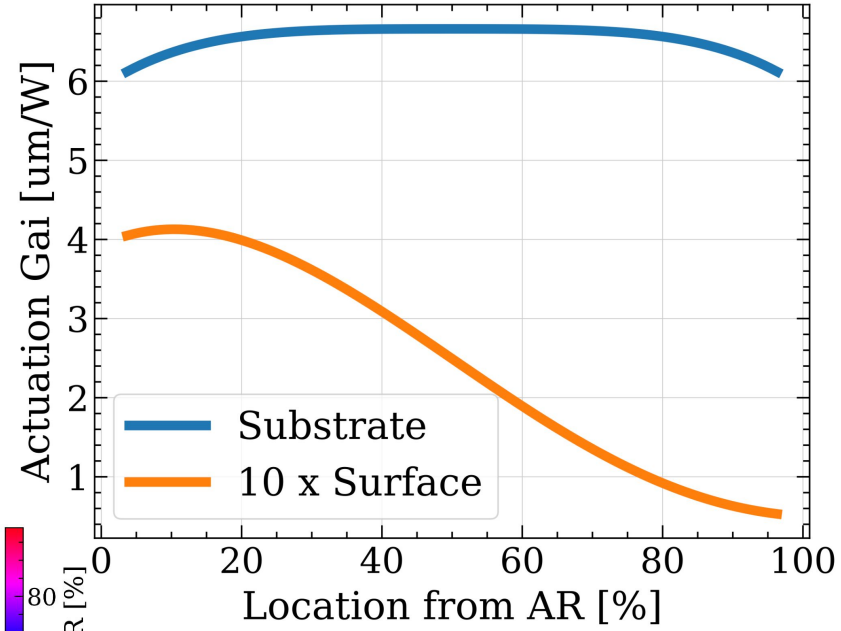
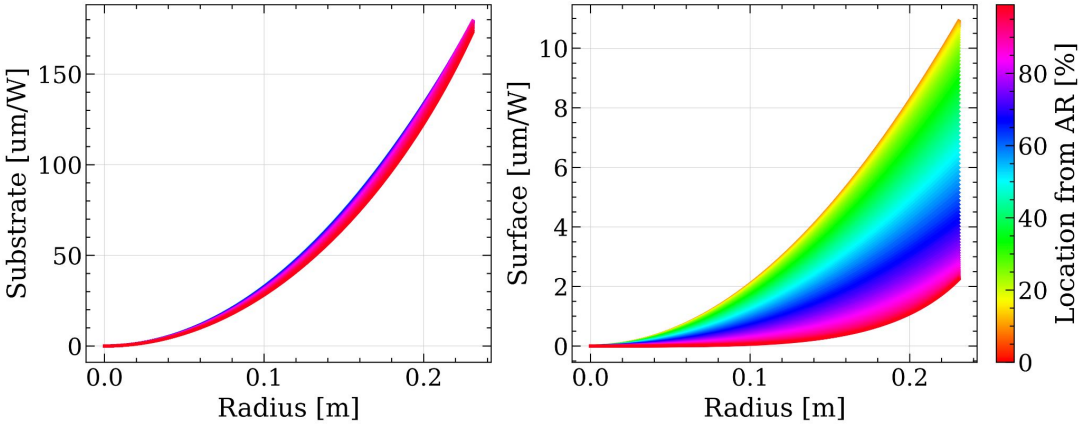
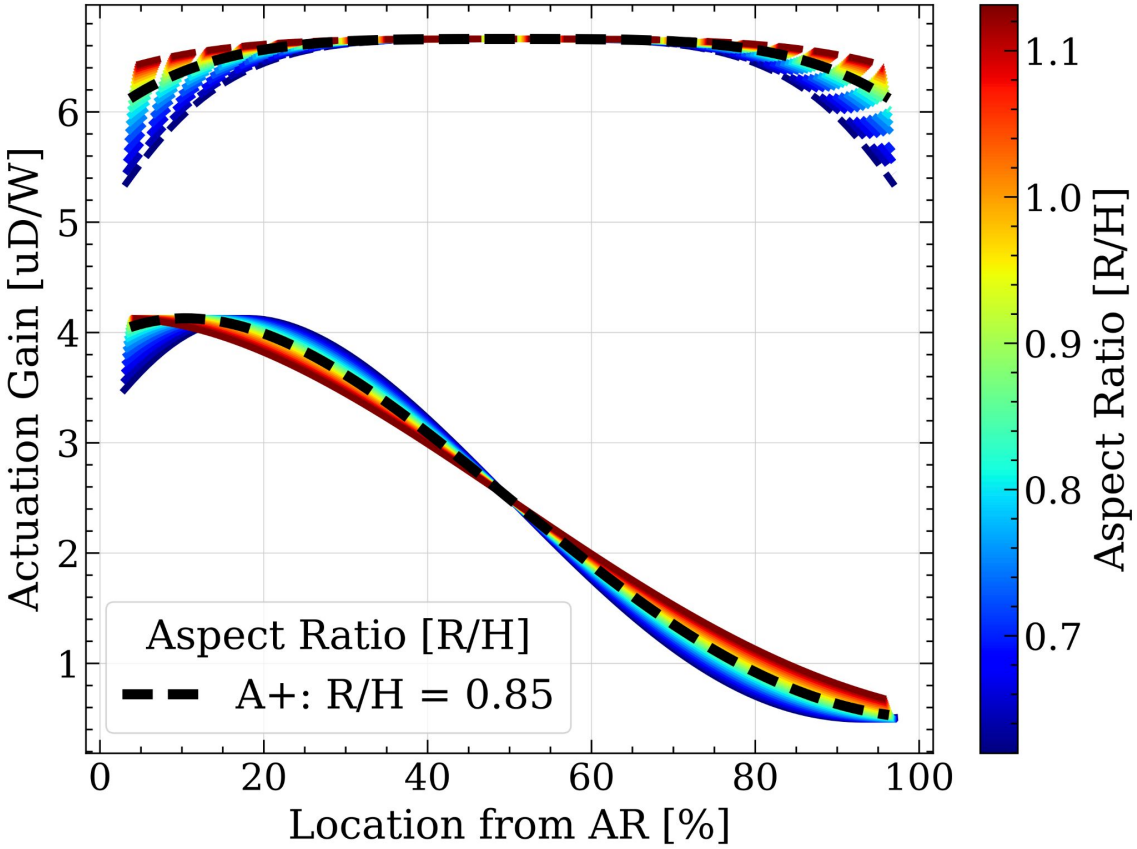
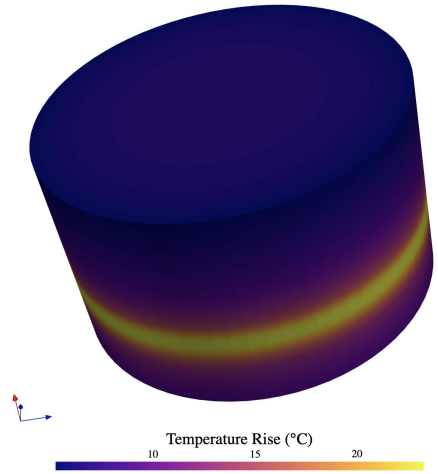




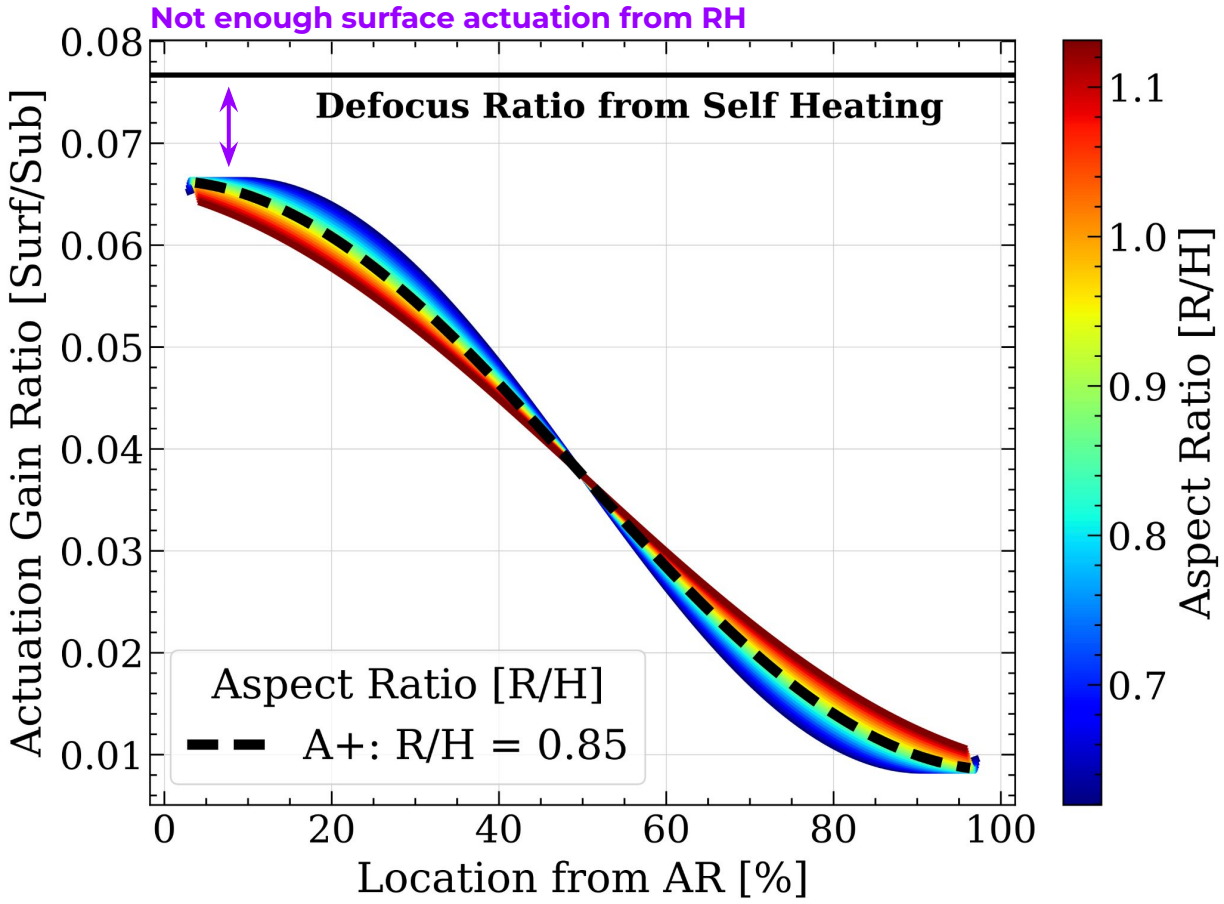
We need (*) even larger surface actuation gain. Change the aspect ratio of the test mass?

* Slightly different results with beam size weighted quadratic fit from Tyler





Allow the aspect ratio to change. The actuation gains vary.



1. The ratio of the actuation gain (surf./sub.) varies according to the RH location, and the aspect ratio.
2. But it is always smaller than the defocus ratio from self heating.

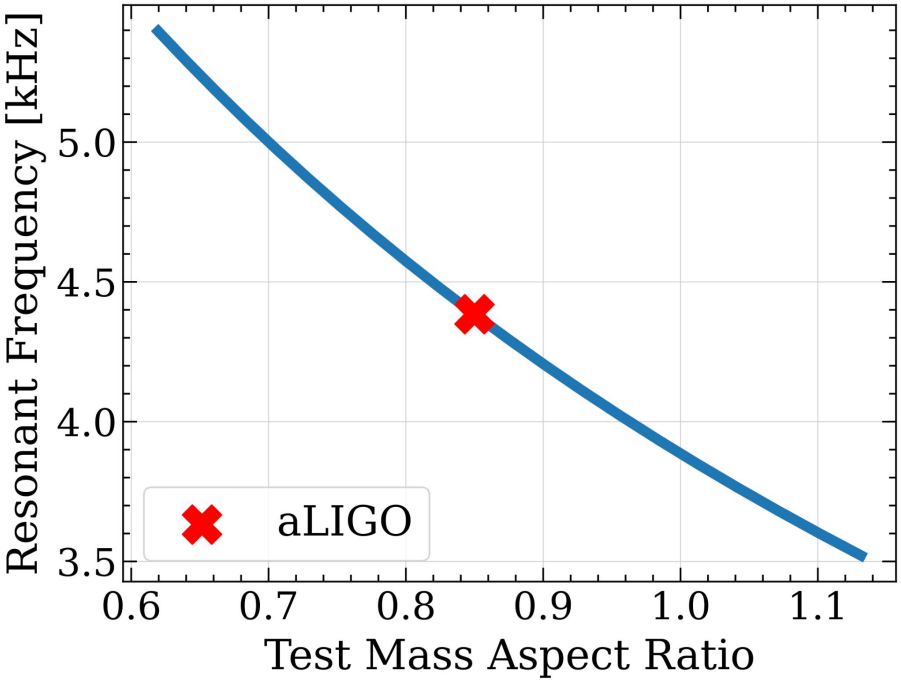
constant aspect ratio, these frequencies scale as $1/R$. For $\alpha \gtrsim 3$, they are well approximated by

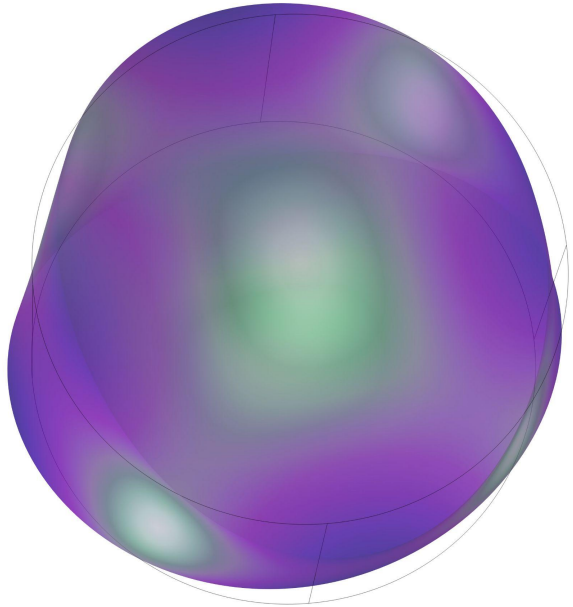
$$f_{\text{butterfly}} = 7.27\,\text{kHz}\left(\frac{4}{\alpha}\right)\left(\frac{5\,\text{cm}}{R}\right) \quad (2a)$$

$$f_{\text{drumhead}} = 10.88\,\text{kHz}\left(\frac{4}{\alpha}\right)\left(\frac{5\,\text{cm}}{R}\right). \quad (2b)$$

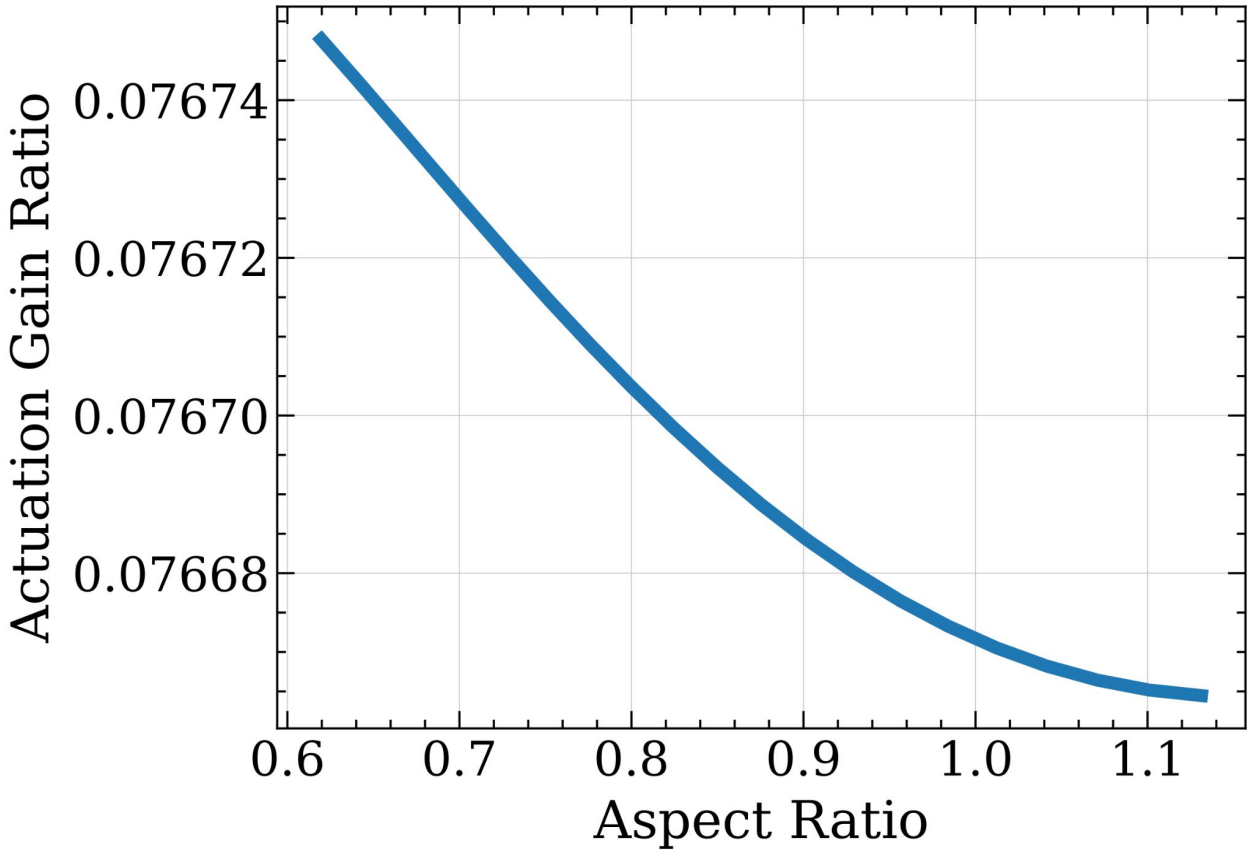
For BS-like optics only

Resonant frequency vs. aspect ratio of the test mass (COMSOL)





Lowest mechanical resonance “butterfly” mode



The defocus ratio from self heating is not strongly affected by the aspect ratio of the test mass